

What is claimed is:

1. An impact absorbing structure for a tilt steering system of a vehicle comprising:

- a steering shaft having a longitudinal rigidity against compression;
- 5 a steering column having a longitudinal rigidity against compression, engaged coaxially and rigidly in a axial direction with the steering shaft;
- a pivot rigidly attached to the steering column, to be an axis of a tilt rotation of the steering column;
- 10 an upper bracket rigidly attached to the steering column for temporarily allowing a tilt motion of the steering column, and adopted to be relatively moved away from a vehicle body in response to an impact; and
- a lower bracket having a notched portion defining a notch with an open end to a front of the vehicle body, rotatably engaged with the pivot in a closed end of the notch, for allowing the pivot being released from the notch in response to the impact.
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2. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 1 further comprising:

- a protrusion formed on an inner periphery of the notch and located adjacent to the closed end of the notch to prevent the pivot from being released from the notch toward the front of the vehicle body.
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3. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 2 wherein:

- the protrusion is formed in the lower side of the notched portion; and
- a deformable portion formed under the notch includes an opening and has a predetermined width and a predetermined height for impact absorption.
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4. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 1 further comprising:

5 a guide formed as a part of the lower bracket, abutting on an underside of the steering column, for preventing the steering column from falling off the lower bracket in response to the impact.

5. An impact absorbing structure for a tilt steering system of a vehicle comprising:

10 a steering shaft having a longitudinal rigidity against compression;
a steering column having a longitudinal rigidity against compression, engaged coaxially and rigidly in a axial direction with the steering shaft;

15 a pivot rigidly attached to the steering column, to be an axis of a tilt rotation of the steering column;

an upper bracket rigidly attached to the steering column for temporarily allowing a tilt motion of the steering column, and adopted to be relatively moved away from a vehicle body in response to an impact;

20 a lower bracket having a notched portion defining a notch with an open end to a front of the vehicle body, rotatably engaged with the pivot in a closed end of the notch, for allowing the pivot being released from the notch in response to the impact; and

25 the lower bracket comprising a deformable portion formed as an impact absorbing portion defining the notch, for being deformed by a release motion of the pivot, while absorbing an impact energy under a condition where an impact load is above an impact load bearing capacity of the deformable portion.

6. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 5 further comprising:

5 a protrusion formed on an inner periphery of the notch and located adjacent to the closed end of the notch to prevent the pivot from being released from the notch toward the front of the vehicle body.

7. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 6 wherein:

10 the protrusion is shaped in part to be fitted to the pivot, for positioning the pivot and preventing the pivot to rattle.

8. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 7 wherein:

15 the pivot abuts on the lower bracket by a predetermined proportion of the periphery of the pivot, the predetermined proportion being determined to position the pivot, to prevent the pivot rattling and to provide a predetermined impact load bearing capacity and a predetermined impact absorbing energy of the deformable portion.

20 9. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 6 wherein:

the protrusion is formed in either one of a lower side and an upper side of the notch.

25 10. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 6 wherein:

the deformable portion includes an opening which is dimensioned to provide a predetermined timing when the pivot is released from the notch of the lower bracket.

11. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 6 wherein:

the deformable portion of the lower bracket is formed by determining
a first length as a width of the deformable portion along a first
5 direction perpendicular both to a forward direction of the vehicle
body and to an axial direction of the pivot, a second length along the
forward direction of the vehicle body from a rear end of the
deformable portion to a center of the pivot, and a third length as a
height of the protrusion along the first direction, the lengths being
10 determined to provide a predetermined impact load bearing
capacity and a predetermined impact absorbing energy of the
deformable portion.

12. The impact absorbing structure for a tilt steering system of a
15 vehicle as claimed in claim 11 wherein:

the predetermined impact load bearing capacity is increased by a
combination of increasing the first length and decreasing the second
length, while the predetermined impact load bearing capacity is
decreased by a combination of opposite changes; and
20 the predetermined impact absorbing energy is increased by a
combination of increasing the first length, decreasing the second
length and increasing the third length, while the predetermined
impact absorbing energy is decreased by a combination of opposite
changes.

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13. The impact absorbing structure for a tilt steering system of a
vehicle as claimed in claim 6 wherein:

the protrusion is formed in the deformable portion; and
the deformable portion includes an opening and has a predetermined
30 width and a predetermined height for impact absorption.

14. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 13 wherein:

the deformable portion of the lower bracket is formed by determining
5 a first length along a first direction perpendicular both to a forward direction of the vehicle body and to an axial direction of the pivot from the opening to the notch, a second length along the forward direction of the vehicle body from a rear end of the deformable portion to a center of the pivot, a third length as a height of the
10 protrusion along the first direction, a fourth length along the forward direction of the vehicle body from a center of the pivot to a front end of the deformable portion, and a fifth length as a height of the opening along the forward direction of the vehicle body, the lengths being determined to provide a predetermined impact load
15 bearing capacity, a predetermined impact absorbing energy of the deformable portion, and a predetermined release timing when the pivot is released from the notch of the lower bracket.

15. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 14 wherein:

20 the predetermined impact load bearing capacity is increased by a combination of increasing the first length, decreasing the second length and decreasing the fifth length, while the predetermined impact load bearing capacity is decreased by a combination of
25 opposite changes;

the predetermined impact absorbing energy is increased by a combination of increasing the first length, decreasing the fifth length and increasing the third length, while the predetermined impact absorbing energy is decreased by a combination of opposite
30 changes; and

the predetermined release timing is delayed by increasing the fourth length, while the predetermined release timing is advanced by decreasing the fourth length.

5 16. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 5 further comprising:

 a guide formed as a part of the lower bracket, abutting on an underside of the steering column, for preventing the steering column from falling off the lower bracket in response to the impact.

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 17. The impact absorbing structure for a tilt steering system of a vehicle as claimed in claim 16 wherein:

 the guide comprises a cylindrically hollowed surface fitted to the underside of the steering column, for allowing the steering column
15 to move smoothly abutting on the guide for impact energy absorption in response to the impact.